§95. Study on Effect of Conectration Effect on Catalytic Combustion of Hydrogen Isotopes

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Recovery of tritium released into the working area of fusion power plants is an important technique to establish the safety of the fusion technology. The catalytic oxidation and adsorption is the most conventional and reliable method for removing tritium that is accidentally released into the working area of these facilities. The catalysts used for these purposes need to have high catalytic performance for low temperature combustion of tritium. The air cleanup system needs to be designed to be able to deal with the air with high volumetric velocity. With this background, the authors examined the effect of concentration of hydrogen isotopes on their catalytic combustion.

The effect of concentration of hydrogen isotopes on their catalytic combustion was investigated using an experimental apparatus shown in Fig. 1. In the experiments, the catalysts were charged in a reactor made of quartz. The temperature of the reactor was varied in the range of 0 to 60 °C. The argon gas containing hydrogen (1000 – 7500 ppm) and oxygen (20%) was introduced to the reactor. The concentration of hydrogen at inlet and outlet stream of the reactor was measured with a gas chromatograph and a mass spectrometer. The flow rate (10,000 1/h of space velocity) was controlled with conventional mass flow controller. The catalyst used in the experiments is a 4.1%/L Pt/Al_2O_3 catalyst (DASH-520) manufactured by NE CHEMCAT Co.

Figure 2 shows the conversions hydrogen with different inlet concentrations over the catalyst used as a function of temperature. As seen in the figure, conversions of hydrogen decreased with decreasing inlet hydrogen concentration. Figure 3 shows the conversions deuterium with different inlet concentrations over catalysts used as a function of temperature. The conversions of deuterium decreased with decreasing inlet hydrogen concentration as well. Figure 4 shows conversions of hydrogen as functions of temperature. In these cases, the inlet concentration of hydrogen was fixed at 1000 ppm and inlet oxygen concentrations were varied. As shown in this figure, the conversions of hydrogen greatly increased when the inlet concentration of oxygen was decreased to as low as 5%, whereas difference in the conversions of hydrogen in the cases of 10% and 20% oxygen concentrations was small. The results shown above indicate that both of the concentrations of hydrogen and deuterium affects the rate of catalytic combustion of hydrogen isotopes.

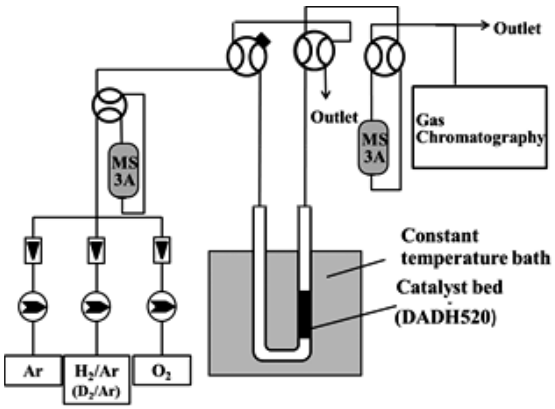

Fig.1 Flow diagram of experimental apparatus

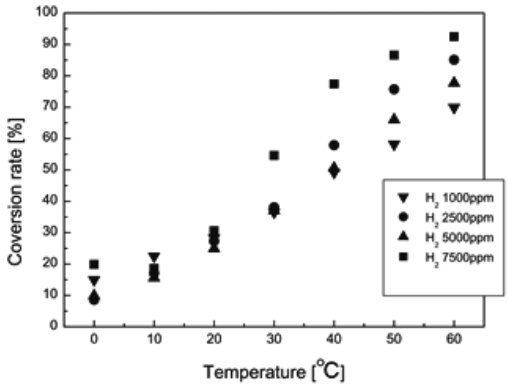

Fig.2 Conversions of hydrogen

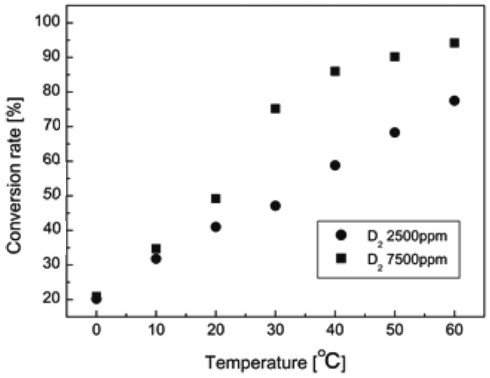

Fig.3 Conversions of deuterium

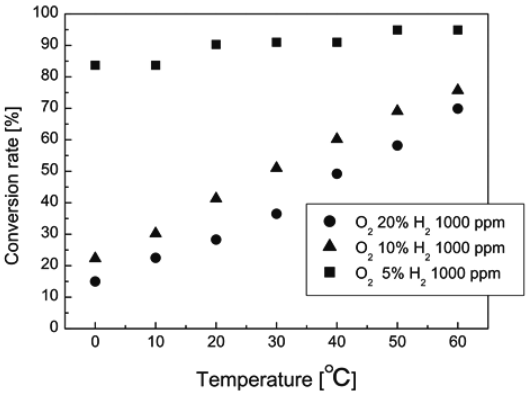

Fig.4 Conversions of hydrogen with different oxygen concentration